CLOSURE HAVING TAPERED SEALING PLUG

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a plastic closure suitable for sealing a container, such as a container for a carbonated beverage.

2. Description of the Related Technology

Most carbonated beverages are conventionally packaged within a container that is either formed from glass or a plastic material such as polyethylene terephthalate and that includes a substantially cylindrical finish portion having an external thread formed on an outer peripheral surface thereof. The finish portion typically has an annular top surface extending substantially horizontally, a cylindrical outer peripheral surface extending substantially vertically, and a cylindrical inner peripheral surface extending substantially vertically. The annular top surface and the cylindrical inner peripheral surface intersect each other either at a discrete edge or via an annular boundary surface that extends arcuately over a slight distance as visualized within a longitudinal cross-sectional view. Similarly, an annular boundary surface, extending substantially arcuately over a considerable length in a longitudinal cross-sectional view, exists between the annular top surface and the cylindrical outer peripheral surface.

It is also conventional to provide a plastic container closure for non-carbonated beverages that is screwable onto the finish portion in order to seal the container. Such closures are typically formed from a plastic material, such as high density polyethylene or polypropylene. A typical example of such a closure has a circular top panel wall, and a cylindrical skirt wall extending downwardly from a peripheral edge of the top panel wall, as disclosed, for example, in U.S. Patent 4,564,112 to Breuer. An internal thread is formed on an inner peripheral surface of the skirt wall. An annular sealing plug depends downwardly from the inner surface of the top panel

wall. This annular sealing plug has an outer circumferential surface that is adapted to seal against the cylindrical inner peripheral surface of the finish portion of the container when the closure is screwed onto the container.

Unfortunately, it is often problematic to mold effective annular sealing plugs because of difficulty of ejecting the molded plug from the mold after fabrication.

In many conventional closure designs, a lining material must be inserted into the closure in a secondary operation in order to provide an effective seal. This adds substantially to the cost of manufacturing the closure and furthermore adds to the weight of the closure.

A need exists for an improved single piece closure having a sealing plug that can be easily fabricated and that does not require insertion of a lining material after molding.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide an improved single piece closure having a sealing plug that can be easily fabricated and that does not require insertion of a lining material after molding. It is further an object of the invention to provide such a closure that is suitable for use with containers for carbonated beverages.

In order to achieve the above and other objects of the invention, a plastic closure for a container according to a first aspect of the invention includes an upper wall; a generally cylindrical sidewall depending downwardly from the upper wall, the sidewall having a threaded internal surface; and an annular sealing plug depending downwardly from a lower surface of the upper wall, the annular sealing plug having an inner annular surface that when viewed in longitudinal cross-section extends at a first angle with respect to a longitudinal axis of the closure and an outer annular surface that when viewed in longitudinal cross-section extends at a second angle with respect to the longitudinal axis, and wherein the first angle is greater than the second angle.

According to a second aspect of the invention, a method of packaging a carbonated beverage includes steps of filling a container with a carbonated beverage; and sealing the container by applying a plastic closure having an upper wall; a generally cylindrical sidewall

depending downwardly from the upper wall, the sidewall having a threaded internal surface; and an annular sealing plug depending downwardly from a lower surface of the upper wall, the annular sealing plug having an inner annular surface that when viewed in longitudinal cross-section extends at a first angle with respect to a longitudinal axis of the closure and an outer annular surface that when viewed in longitudinal cross-section extends at a second angle with respect to the longitudinal axis, and wherein the first angle is greater than second angle.

These and various other advantages and features of novelty that characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and the objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a diagrammatical cross-sectional view depicting a closure that is constructed according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring now to the drawings, wherein like reference numerals designate corresponding structure throughout the views, and referring in particular to FIGURE 1, a plastic closure 10 for a container 12 includes an upper wall 13 that is generally circular in shape as viewed from above or below and a generally cylindrical downwardly depending sidewall 14 that is unitary with the upper wall 13 and that depends downwardly to form a skirt or apron. Closure 10 is preferably fabricated from an appropriate plastic material such as high density polyethylene or polypropylene. Upper wall 13 and sidewall 14 are preferably constructed of sufficient thickness to resist significant distortion as a result of forces that are exerted on the closure 10 by the pressurization created by a carbonated beverage.

Closure 10 further includes in the preferred embodiment a tamper-evident band 16 that is frangibly attached to the sidewall 14 and that includes a retention hook 18 that is designed to engage structure on the container 12 in order to cause separation between the sidewall 14 and the tamper-evident band 16 upon removal of the closure 10 from the container 12 by a consumer. Sidewall 14 is provided with a plurality of internal threads 20 that are constructed and arranged to interengage with complementary threads that are formed on the outer peripheral surface of the finish portion of the container 12. This permits the closure 10 to be screwed onto and off of the container 12.

Referring again to FIGURE 1, closure 10 further includes an advantageously constructed annular sealing plug 22 that is unitary with and depends downwardly from the lower surface 24 of the upper wall 13. Annular sealing plug 22 preferably is substantially symmetrical about the longitudinal axis of the closure 10, meaning that the profile of the annular sealing plug 22 that is provided in the cross-sectional view of FIGURE 1 would be substantially identical in any other possible longitudinal cross-sectional view of the closure 10. Annular sealing plug 22 has an inner annular surface 26 that includes a linear portion 28 as viewed in FIGURE 1 that extends for substantially the entire length of the inner annular surface 26 and that intersects with the lower surface 24 of the upper wall 13. Linear portion 28 is angled downwardly and outwardly toward the sidewall 14 at a first angle Θ with respect to a vertical line that is parallel to the longitudinal axis of the closure 10. Preferably, this first angle Θ is at least 2°, is more preferably at least 10° and is most preferably at least 15°. In the most preferred embodiment, this first angle Θ is approximately 17°.

While portions 28, 32 have been described as linear, it will be visualized that the true shape of the surfaces is substantially frustoconical.

Annular sealing plug 22 further preferably has an outer annular surface 30 that includes a linear portion 32 as viewed in longitudinal cross-section that extends for most of the length of the annular outer surface 30 including the intersection of the annular outer surface 30 and the lower surface 24 of the upper wall 13. Linear portion 32 defines a second angle Φ with respect to a vertical line that is parallel to the longitudinal axis of the closure 10. According to one important

aspect of the invention, the first angle Θ is greater than the second angle Φ so as to downwardly taper substantially the entire body of the annular sealing plug 22. This has been determined to make the closure 10 easier to mold, particularly in the area about the annular sealing plug 22. Preferably, the first angle Θ is greater than the second angle Φ by at least 2°. The second angle Φ could range from 0° upwards, as long as it is smaller than the first angle Θ.

Preferably, the annular sealing plug 22 further includes an annular radiused end portion 34 that intersects the outer annular surface 30 at a smooth feathered radius, and that intersects the inner annular surface 26 at a lower edge 36.

The invention also encompasses a method of packaging a carbonated beverage that is performed by inserting a carbonated beverage into a container and subsequently sealing the container using the closure 10 described above.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.